

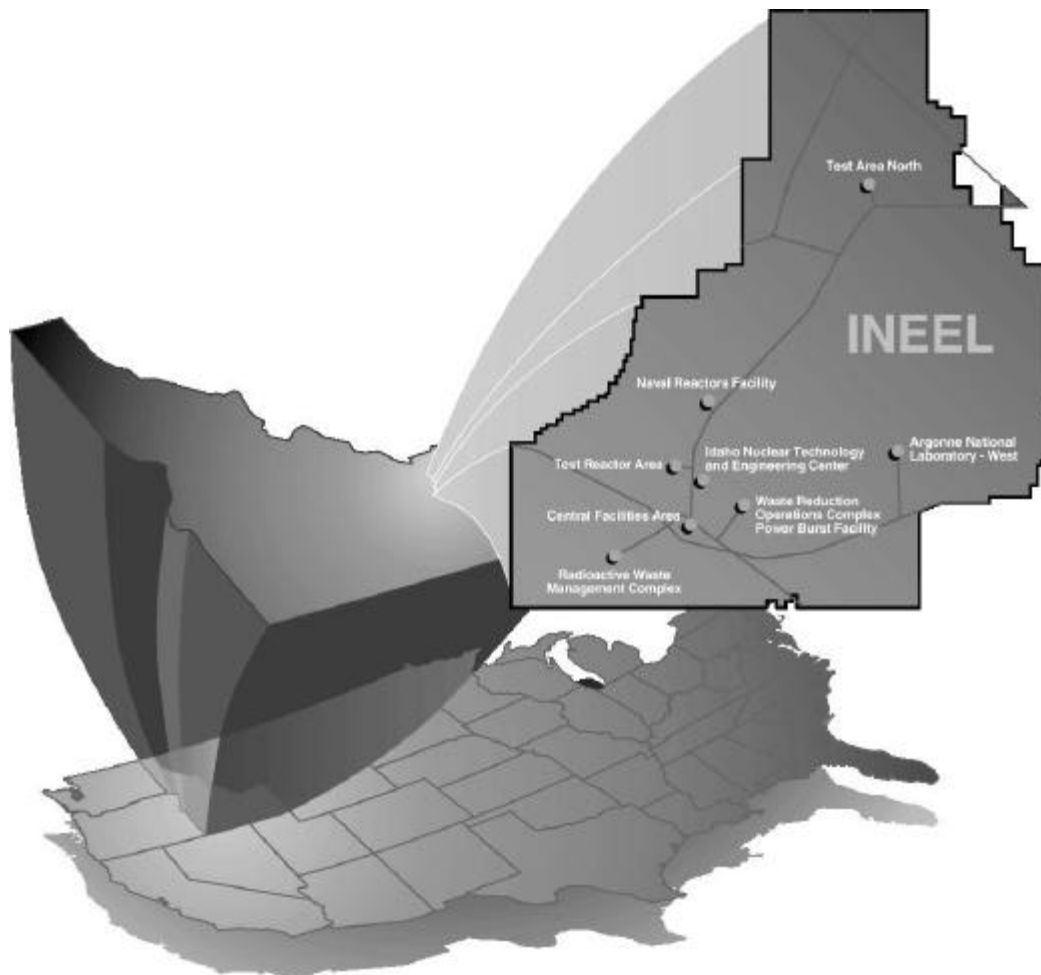
3. AFFECTED ENVIRONMENT

3.1. General Site and Facility Description

The INEEL is an 890 square mile DOE facility located in southeastern Idaho (Figure 3-1). The DOE Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement, DOE/EIS-0203-F, April 1995 (FEIS) (DOE 1995a) describes the physical and biological environment of the region, in general, and the INEEL in particular. The following sections describe specific information for air, water, biological, and cultural/historical resources, as it relates to wildland fires on the INEEL.

The INEEL consists of several facility areas situated on an expanse of otherwise undeveloped, cool-desert terrain. Buildings and structures at the INEEL are clustered within those site areas, which are typically less than a few square miles in size and separated from each other by miles of primarily undeveloped land (Figure 3-1). DOE controls all land within the INEEL. The INEEL occupies portions of five Idaho counties: Butte, Bingham, Bonneville, Clark, and Jefferson.

Population centers in the region include large cities (>10,000) such as Idaho Falls, Pocatello, and Blackfoot located to the East and South and several smaller cities (<10,000) located around the site such as Arco, Howe, and Atomic City. [Yellowstone and Grand Teton National Parks and the City of Jackson](#)



[Figure 3-1. Illustration showing the INEEL and site areas in southeastern Idaho.](#)

Hole, Wyoming are located less than 60 miles to the northeast. There are no permanent residents on the INEEL.

3.2. Air Resources

The area surrounding the INEEL is classified as a Prevention of Significant Deterioration (PSD)-Class II Area, designated under the Clean Air Act (CAA) as an area with reasonable or moderately good air quality while still allowing moderate industrial growth. About 12 miles west of the INEEL is Craters of the Moon National Monument and Wilderness Area. The Wilderness is classified as a PSD Class I Area. Planned activities at the INEEL must not negatively impact the air quality in this Class I Area.

Local mountains and valleys influence wind patterns on the INEEL. The prevailing westerly winds in the area are channeled within the Eastern Snake River Plain into west-southwest and southwest flows. These winds are strongest in the spring. At night, winds may reverse direction due to down-slope flows from the mountains to the north of the INEEL. At Test Area North (TAN) (northern portion of the site); the closer proximity of the mountains causes wind patterns to be somewhat different than at the other sites.

A significant cause of fires on and around the INEEL is lightning strikes during thunderstorms. Lightning caused nine of the 14 fires on the INEEL during CY 2000 (E. Gosswiller, pers. com.). The INEEL experiences an average of 2-3 thunderstorm days¹ each of the summer months from June through August. Several individual thunderstorms may occur during each of those thunderstorm days (Clawson et al., 1989).

The INEEL routinely monitors air quality using a network of air monitors. These monitors collect samples for measurement of particulate matter (both total suspended particulate and *PM10*), radioactivity, and other air pollutants.

Wildfires impact air quality in several ways through direct and indirect emissions of:

- Smoke during fires
- Dust from denuded landscapes following fires
- Dust from fire prevention and firefighting (such as creating defensible space and cutting containment lines).

Wind erosion can be significant following a fire. For instance, the weekly concentrations following a wildland fire (as measured at Test Reactor Area [TRA]) can be as high as 500 micrograms of particulate per cubic meter of air sampled ($\mu\text{g}/\text{m}^3$), which is significantly higher than the typical average weekly concentration of less than $25 \mu\text{g}/\text{m}^3$.

Following the fire August 16, 1995, the INEEL conducted soil erosion monitoring at four burned locations on the INEEL. Results of the monitoring revealed that one location gained soil, and three locations lost soil. Most of the



Figure 3-2. Windblown sediment after a fire event.

¹ A thunderstorm day is defined by National Weather Service as a day on which thunder is heard at a given observing station. Lightning does not have to be seen, and rainfall and/or hail is not required.

soil was transported by the wind (Figure 3-2). The maximum measured erosion rate was 239 tons of soil per acre per year (Olson 1996). Erosion rates of 200 tons/acre/year are typical for measurements conducted by the BLM on burned land in and around the INEEL and are significant when compared to the typical slight deposition erosion rates for unburned land on the INEEL (Jeppesen 2001). Erosion rates of 5 tons/acre/year or more are considered detrimental to farmland. Erosion rates detrimental to rangeland have not been established, but are likely less than 5 tons/acre/year.

Wildfires burning through SCAs can have additional impacts. SCAs were initially identified and posted to provide interim control of the areas until they could be evaluated and, if necessary, cleaned up under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). Because most of these areas are covered with burnable vegetation, wildfires present the potential for releasing radionuclide contamination to the air. These releases could occur due to any or all of the following:

- Burning contaminated vegetation (contaminated through root uptake of radionuclides),
- Disturbing, thereby resuspending, contaminated soil with firefighting vehicles, or
- Resuspension of contaminated soil by a windstorm following a burn.

Lipp (1994) cataloged 35 SCAs on the INEEL. Staley et al. (2001) examined these 35 sites, as well as one large but lightly contaminated CERCLA site in terms of potential for fire and subsequent contaminated dust release, and calculated both onsite and offsite doses from exposures to fire smoke and dust. Many of the SCAs were eliminated from detailed examination based on several criteria:

- Areas cleaned up or covered
- Areas inside facility fences and therefore protected from burning
- Areas with contamination levels below thresholds levels.

Of the initial 35 SCAs, six SCAs and a large CERCLA site (CPP-95) were retained for detailed analysis (Table 3-1). It should be noted that the six SCA's account for 0.05% of the total INEEL land area; 0.4 % if CPP-95 (the large CERCLA site with Cesium contamination below the CERCLA ~~no-no~~-action threshold) is added. In this EA, "SCA" refers collectively to these seven areas. In addition, the INEEL is concerned that radioactive contamination from wildland fires may contaminate the clean caps of two sites: SL-1 and BORAX-02.

3.3. Water Resources

Hydrology on the INEEL includes water from three streams (Figure 3-3) and from local runoff caused by snowmelt. The three streams are the Big Lost River, Birch Creek, and the Little Lost River. On the INEEL, the Big Lost River is either diverted southward to the spreading areas or flows northward, through a wetland (Big Lost Sinks), to three playas. Since 1965, there ~~was~~ have been several periods of continuous stream flow; the longest, a during a 5 year and 9 year period between May 1968 and May 1977 interrupted by periods of no flow and annual volumes have exceeded 300,000 acre-feet. The longest period of continuous flow was a 9-year period between May 1968 and May 1977. Typically, Birch Creek flows to the INEEL during the non-irrigation season and terminates on an alluvial fan. The Little Lost River is often depleted by irrigation diversions and infiltration in the Little Lost River sinks, and infrequently flows onto the INEEL. All three streams receive water from mountain watersheds located to the north and northwest of the INEEL. Water either evaporates or infiltrates because the INEEL is within a topographic depression with no outlet. The Snake River Plain Aquifer underlying the INEEL is recharged by infiltration of surface water and is used extensively for drinking, irrigation, and aquaculture. The INEEL pumps water from the aquifer to use for operations, drinking, and lawn watering. During 2000, the INEEL pumped 3500 acre-feet of water, about 10% of the INEEL's federally reserved water

Table 3-1. SCAs and soil contamination levels modeled for fire and post-fire releases.

Site	Site Description	Area (m ²)	Nuclide	Surface Soil Contamination Level (pCi/g)
CFA-08, (OU 4-08) ¹	CFA 691 Drainfield	18605	Cs-137	89
CFA/DP ²	CFA ditch and pit	4047	Cs-137	92
EBR-15 ³	Large SCA inside EBR-I fence	13900	Cs-137	1.8
ARA-12 ⁴	SCA across from ARA-III	5750	Ag-108m	20.8
ARA-23 ⁴	SCA near ARA I & II, & SL-1 burial site	1,043,000	Cs-137	88.5
			Sr-90	0.84 ⁵
			RA-226	1.35 ⁶
CPP-95 ⁷	INTEC Windblown Area	8,068,858	Cs-137	13.0
			Sr-90	1.10
TSF-07 ⁸	TAN Disposal Pond for septic tank & groundwater treatment	380	Am-241	0.021
			Cs-134	0.013
			Cs-137	50.9
			Co-60	55.1
			Ra-226	2.3
			Th-234	1.2

1. DOE-ID 2000a, b	ARA	Auxiliary Reactor Area
2. Oertel 2000	CFA	Central Facility Area
3. Haney 2000	CPP	Chemical Processing Plant
4. DOE 2000b	EBR-1	Experimental Breeder Reactor I
5. Ave. of 1998 samples	TSF	Test Support Facility
6. DOE-ID 1999		
7. DOE-ID 1997b		
8. DOE-ID 1997c		

right. The aquifer's economic and environmental significance has been recognized by the U.S. Environmental Protection Agency (EPA) designation as a sole source aquifer.

The average annual precipitation is 8.70 inches at the Central Facilities Area (CFA) and 7.85 inches at TAN (Clawson et al. 1989). Peak rainfall occurs during May and June, but high infiltration rates preclude significant accumulation of surface waters. The water content of snow contributes between one-quarter and one-third of the total yearly precipitation. Local snowmelt has necessitated the construction of surface water management features, such as deep injection wells at TAN, CFA, and Power Burst Facility (PBF); dikes and retention basins at TAN; a water control structure at Argonne

National Laboratory – West (ANL-W); and several drainage channels. Localized flooding occurred at Radioactive Waste Management Complex (RWMC); so, a flood control channel was constructed to convey snowmelt to the Big Lost River. Ice jams in the Big Lost River threatened flooding of TRA and Idaho Nuclear Technology and Engineering Center (INTEC) and necessitated construction of a small diversion dam.

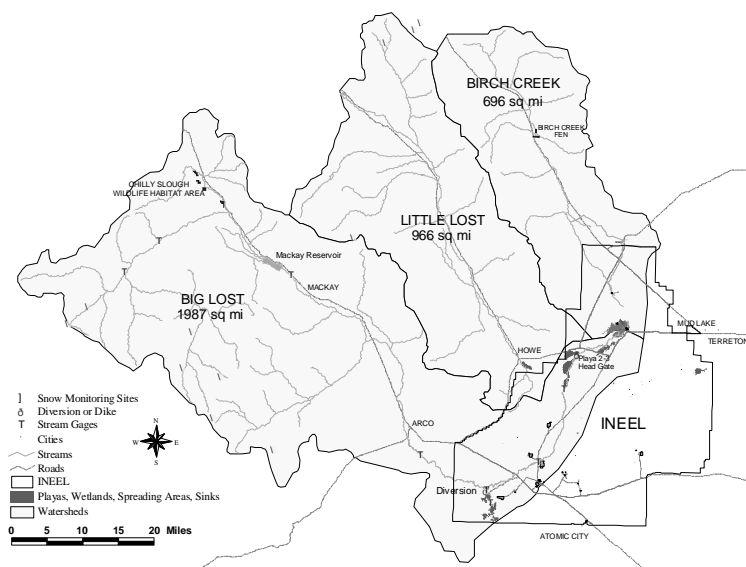


Figure 3-3. Illustration showing the surface water on the INEEL.

3.4. Wildlife/Habitat Resources

The INEEL contains the largest remnant of undeveloped, ungrazed sagebrush steppe ecosystem in the Intermountain West (DOE-ID 1997a). That ecosystem has been identified as critically endangered with less than two percent of its original vegetation remaining (Noss et al. 1995, Saab and Rich 1997). Because it contains the largest remnant of this ecosystem type, the INEEL is an internationally significant ecological resource. The natural vegetation of the INEEL consists of a shrub overstory with a forb and grass understory. The most common shrub is Wyoming big sagebrush. Basin big sage may dominate or co-dominate with Wyoming big sage in areas with deep or sandy soils (Shumar and Anderson 1986). Green rabbitbrush is the next most abundant shrub. Other common shrubs include winterfat, spiny hopsage, gray horsebrush, gray rabbitbrush, and prickly phlox (Anderson et al. 1996).

The shrub understory consists of a variety of grasses and forbs. The most common native grasses include thickspiked wheatgrass, Indian ricegrass, bottlebrush squirreltail, needle-and-thread grass, Nevada bluegrass, and bluebunch wheatgrass. Common native forbs include tapertip hawksbeard, Hood's phlox, hoary false yarrow, paintbrush, globe-mallow, buckwheat, lupine, milkvetches and mustards (Anderson et al. 1996).

Anderson et al. (1996) broadly described ten vegetation classes and plant communities that occur on the INEEL. Those communities do not represent homogeneous community types, but integrate communities that share dominant species and are more similar to each other than to communities represented by other vegetation classes. Sagebrush steppe is the dominant plant community or vegetation type on the INEEL. Other community types include: juniper woodlands, grasslands, low shrubs on lava, sagebrush-rabbitbrush, sagebrush-winterfat, salt desert shrub, wetlands. In addition, playas, bare ground or disturbed areas, and lava are also considered community types.

Several large fires have occurred on the INEEL over the past decade burning over 130,000 acres. A study conducted by Patrick and Anderson (1999) indicated that if healthy populations of native species are present on a site when wildfire occurs, the native community can recover and resist invasion by *exotic species*. Wyoming big sagebrush can take 30 years or more after a fire to become re-established (Watts and Wambolt 1996, Wambolt et al. 2001). Estimates of fire return intervals for sagebrush steppe range from about 20 to more than 100 years (Houston 1973, Wright et al. 1979, Wright and Bailey 1982). Because Wyoming big sagebrush is generally considered to be the slowest of the sagebrush species to return following fire, it is likely that fire return intervals on the INEEL are at the upper end of that range.

The introduction of cheatgrass and other exotic annual plant species has altered the effects of fire in the sagebrush steppe ecosystem. Wildfire in areas where the understory is dominated by cheatgrass results in the conversion of native sagebrush steppe to annual grasslands (Hosten and West 1994). Dense stands of cured cheatgrass are highly flammable and can result in an increased fire frequency of three to five years (Young and Evans 1978, Wright and Bailey 1982). The increased fire frequency greatly limits, if not prohibits the ability of native species to recover.

Long-term trend plots on the INEEL showed a rapid invasion of cheatgrass between 1965 and 1975, even in areas that had not been grazed for 20 or more years (Anderson and Inouye 2001). Even though cheatgrass can be found on much of the INEEL, its abundance is limited. Although it does not presently appear to be a significant threat on the INEEL, cheatgrass has become dominant in isolated patches in areas with shallow or coarser soils. Probably the most important risk factors for cheatgrass dominance on the INEEL are surface disturbance and loss of native perennial plants. Anderson and Inouye (2001) reported that native plant cover inhibited cheatgrass cover. Cheatgrass is seen at greatest densities on sites where the soil has been disturbed to the extent that native perennial plants have been removed.

Unlike other parts of the West, wildfire on the INEEL does not necessarily condemn the area to cheatgrass domination (Patrick and Anderson 1999).

Because soil disturbance increases the likelihood for invasion by non-native plants more ~~that than~~ just fire alone, a vegetation survey was conducted on containment lines from previous fires and firebreaks constructed before the 2001 fire season began. Vegetation surveys were conducted to obtain information on the response of plant species to fire and soil disturbance (See Appendix A). Although no plant species listed under the Federal ESA were located, exotic invasive species were identified in several areas.

A total of 219 vertebrate species have been recorded on the INEEL (Reynolds et al. 1986). Several vertebrate species present on the INEEL are considered sagebrush-obligate species, meaning that they rely upon sagebrush for survival. Among others, those species include: sage sparrow, Brewer's sparrow, northern sagebrush lizard, sage grouse, and pygmy rabbit.

Fish species present in the Big Lost River on the INEEL include rainbow trout, brook trout, mountain whitefish, sculpin and kokanee salmon (Overton 1977).

The ESA provides Federal protection for certain species of plants and animals and their critical habitats, and authorizes the Secretary of the Interior to develop and implement recovery plans for each listed species. Species and/or habitat that are currently listed as Endangered, Threatened, a Species of Concern, or Candidate Species¹ and may occur on the INEEL include: gray wolf, bald eagle, ~~Ute ladies' tresses, yellow-billed cuckoo, slender moonwort,~~ long-eared myotis, small-footed myotis, Townsend's big-eared bat, pygmy rabbit, Merriam's shrew, greater sage-grouse, long-billed curlew, ferruginous hawk, northern sagebrush lizard, painted milkvetch, and loggerhead shrike. Status of these species is shown in Table 3-2). ~~The FWS has indicated² concerns about several plants and animals that do or may occur on the INEEL. Although these species have no status under the ESA, FWS is concerned about their population status and threats to their long-term viability. In context with ecosystem-level management, the FWS suggests that these species and their habitats be considered in project planning and review.~~

¹ Endangered, Threatened and Candidate are special terms under the ESA that list the status of plant or animal species. Species of Concern is an informal term that refers to species whose conservation status may be of concern but do not receive protection under the ESA. Designation as a species of concern does not mean a species will eventually be proposed for listing under the ESA.

² ~~Letter from Snake River Basin Office, USFWS to Roger Blew, September 1, 2001; Department of Energy, Idaho National Engineering and Environmental Laboratory Species List Update; 1-4-01-SP-1118/Updates #1-4-01-SP826/506-0000.~~

The INEEL is also a NERP. DOE established the NERP program in the early 1970s and the Idaho NERP was chartered in 1975. The primary objectives for research on the NERPs are to develop methods for assessing the environmental impact of energy development activities, to develop methods for predicting those impacts, and to develop methods for mitigating those impacts. Included in the NERP's research activities is the long-term vegetation transect. These transects were established in 1950 and have been read on a regular basis since then. The data from these transects represents one of the longest-term rangeland vegetation databases in the western United States. A portion of the INEEL has been designated as the Sagebrush Steppe Ecosystem Reserve that has a mission to conducting-provide research opportunities on-and preserving-preserve sagebrush steppe habitat (see Section 1.3).

3.5. Cultural/Historical Resources

The INEEL has been a federal reservation with restricted public access since the early 1940s. Due to both its continuous access restriction and geographic remoteness, the rich and varied cultural resource record within the INEEL boundary is remarkably well preserved. This includes fossil localities that provide an important paleontological context for the region and the many prehistoric archaeological sites preserved within it. The latter sites, including campsites, *lithic workshops*, *cairns*, and hunting blinds, among others, are also an important part of the INEEL inventory because they provide information about the activities of aboriginal hunting and gathering groups who inhabited the area for about 12,000 years. In addition, archaeological sites, pictographs, caves and many other features of the INEEL landscape are also important to contemporary Native American groups for historic, religious, and traditional reasons. Historic sites, including the abandoned town of Pioneer/Powell, a northern spur of the Oregon Trail known as Goodale's Cutoff, many small homesteads, irrigation canals, sheep and cattle camps, and stage and wagon trails, document the use of the area during the late 1800s and early 1900s. Finally, many

Table 3-2. Federal and state listed threatened, endangered, candidate or sensitive species occurring or potentially occurring on the INEEL.¹

Common Name	Scientific Name	Federal (FWS) status ²	State (IDFG) Status ²
Painted milkvetch	<i>Astragalus ceramicus</i> var. <i>apus</i>	SC	
Slender moonwort	<i>Botrychium lineare</i>	C	
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	T
Ferruginous hawk	<i>Buteo regalis</i>	SC	
Long-billed curlew	<i>Numenius americanus</i>	SC	
Loggerhead shrike	<i>Lanius ludovicianus</i>		SC
Gray wolf	<i>Canis lupus</i>	XN	XN
Sage grouse	<i>Centrocercus urophasianus</i>	SC	SC
Pygmy rabbit	<i>Brachylagus idahoensis</i>	SC	SC
Townsend's western big-eared bat	<i>Corynorhinus townsendii</i>	SC	SC
Merriam's shrew	<i>Sorex merriami</i>	SC	
Long-eared myotis	<i>Myotis evotis</i>	SC	
Small-footed myotis	<i>Myotis ciliolabrum</i>	SC	
Northern sagebrush lizard	<i>Sceloporus graciosus graciosus</i>	SC	

1. This table was compiled from the USFWS Species List update #1-4-02-SP-921 and a list provided by the Idaho Department of Fish and Game, Region 6.

2. Status Codes: T = Threatened; SC = Species of Concern; C = Candidate; XN = Experimental, Non-essential.

scientific and technical facilities inside the INEEL boundaries have preserved important information on the historic development of nuclear science in America (DOE-ID 1995b).

The diversity and uniqueness of INEEL cultural resources became known when sporadic archaeological investigations began on the INEEL in the late 1950s and continued to increase as a result of issuance of Section 106 of the National Historic Preservation Act (NHPA), and the creation of the INEEL CRMO in 1989 (DOE 1995b)

While only 7-8% of the total 890-square mile reserve has been surveyed (about 42,900 acres out of 570,000), this has resulted in nearly 2,000 archaeological locations and over 200 historic buildings being identified to date. A preliminary predictive model suggests that there may be as many as 75,000 additional prehistoric archaeological sites as yet undiscovered within the boundaries of the INEEL and many more historic sites, structures and artifacts are known to exist from the post-contact period, Euro American westward expansion and the subsequent post-1940s federal activities (Arrowrock Group Inc. 1998, Ringe 1995).

Geographically, the INEEL is included within a large territory once inhabited by, and still of importance to, the Shoshone-Bannock Tribes. To the Shoshone-Bannock people, cultural resources include not only archaeological sites that may be affiliated with their history, but also many kinds of natural resources such as traditionally used plants and animals. Finally, features of the natural landscape such as buttes, rivers, and caves are known to have particular significance to the Tribes

Beginning in 1995, INEEL CRMO personnel have randomly documented adverse effects to cultural resources on the INEEL as the result of fire suppression activities associated with numerous wildland fires. In the fall of 2001, CRMO personnel surveyed approximately 128 acres associated with the Middle Butte Burn (July 2001), locating eight (8) cultural resource sites. All eight sites (six prehistoric lithic scatters, one prehistoric isolate, and one historic WWII military site) exhibited damage from containment lines and off-road vehicular traffic. Additionally, reconnaissance investigations were conducted in other areas known to possess highly sensitive and significant archaeological resources and recently impacted by fire suppression activity within the past few years. Aviator's Cave is arguably one of the most important archaeological locations on the INEEL. It is also considered by the Shoshone-Bannock Tribes to be an important cultural location. As a result of the Argonne burn of 1999, containment lines were constructed within 30-meters of the site and significant vehicular traffic on the site resulted in severe churning of surface artifacts, yielding diminished confidence levels for contextual information.

Reconnaissance was also conducted at various locations along the Big Lost River, south of Highway 20. This area is also extremely sensitive archaeologically and a number of instances were noted where containment lines and off-road vehicular traffic resulted in damage to cultural resources. These findings, supported by past observations, indicate that containment line and off-road vehicular traffic are the most significant causal factors for damage to cultural resources. Containment lines have bisected archaeological sites, churning under portions of them thus destroying contextual information. Wind blown sediments directly resulting from the lack of vegetation within the containment lines and adjacent lands has covered and obscured artifact distribution, and cultural material has been moved out of context due to water erosion and rilling originating in the containment lines.

Containment lines, along with new roads for staging purposes, have resulted in increased accessibility to significant and sensitive cultural resources on the INEEL such as Aviator's Cave. Removal of vegetative cover also makes cultural resources more visible, thereby increasing the potential for unlawful collection. The CRMO staff have recorded tire tracks plus debris from trespass. Other activities that have the potential to adversely affect cultural resources include, but are not limited to, mowing vegetation, blading roads or other areas, or grubbing and removal of vegetation by mechanical means including controlled burns, or firebreak emplacement.

3.6. Areas of Previous Wildland Fire Response Impacts

Previous wildland fire emergency response actions have historically and in the recent past (since 1994), affected parts of the INEEL. Figure A-4 (Appendix A) shows the location of firebreaks and containment lines from recent emergency response actions. These actions include many of the pre-fire and fire

suppression activities such as blading roads, creating containment lines, and clearing vegetation (Figure 3-4 and Figure 3-5). The INEEL has not actively or successfully mitigated or restored most of those areas. Old containment lines surrounding many of the old wildfires are characterized by bare soil or are covered with weeds, including non-native vegetation. In addition, the biological and cultural resources located in those areas have likely been adversely impacted (see Sections 3.3, 3.4 and 3.5). Further, soil-disturbing activities have likely increased the potential for soil erosion and subsequent sediment releases to the Big Lost River and Birch Creek.

Those areas now represent part of the affected environment. However, there is still a need to identify and restore those areas to prevent further impacts.



Figure 3-4. Example of previous disturbance.



Figure 3-5. Containment line showing larger soil "ricks" and little recovery of native perennial vegetation.